XXVI International Conference – Forest Biobased Materials - TECNICELPA 2023
11, 12, 13 October 2023 – COIMBRA, Portugal

THE IMPACT OF BLEACHING CONDITIONS ON THE VISCOSITY OF HARDWOOD PULP

Petya I. Mileva-Petrova, Ivo V. Valchev, Stoyko A. Petrin
University of Chemical Technology and Metallurgy, 8 "St. Kl. Ohridski" bul., 1756 Sofia, Bulgaria

INTRODUCTION

Positive results have been achieved in recent years in upgrading the paper-grade pulp to dissolving pulp type as raw material for Lyocell fiber. The pentosans content in such pulps is significantly higher than in the dissolving pulps currently employed for this purpose. The SCAN viscosity is on important parameter influencing in particular the processing of pulps in the production of spinning solutions. The bleached pulp viscosity must be low and within a small target window (320 to 400 ml/g) for the Lyocell process. Otherwise, problems can occur during production. Lower viscosities lead to a worsening of the mechanical properties of the lyocell products. Higher viscosities may in particular lead to an increased viscosity of the spinning solution, so that spinning is slower overall.

The purpose of the present study is to evaluate the possibilities of controlled decreasing of final pulp viscosity by moderate changes in bleaching conditions.

EXPERIMENTAL

Paper grade hardwood pulps from "Svilocel" EAD ware used in this investigation. The effects of higher alkali charge, reaction time, and addition of peroxides in the oxygen delignification and extraction steps were investigated. Hot chlorine dioxide bleaching was studied at higher acid consumption and at different temperatures and reaction times. The effect of alkalinity in the final chlorine dioxide stage and hypochlorite addition was also investigated. Chemical analyzes have been carried out according to the standard procedures: Pentosan by Tappi - T223 cm10,Viscosity by SCAN CM 15:18, KAPPA by ISO 350, Bleaching by ISO 3688, AOX by SCAN CM 44:97 and ClO_2 by Standard J.22 P – 2003.

RESULTS AND DISCUSSION

The results from that investigations show that the hot chlorine dioxide stage, the alkaline conditions in final chlorine dioxide stage and the addition of peroxides in the oxygen delignification and extraction steps do not provide a significant degree of polymerization (DP) reduction of the pulp. Better results are obtained after oxygen delignification at a higher alkali charge.
A significant reduction in pulp DP is observed after addition of hypochlorite in the extraction stage. Experiments in EO stage ware carried out at alkali carge of 2%, 3% and 4% as NaOH (0, 1.08, 1.62 and 2.16 as aCl). The D_1 stage was carried out under neutral conditions, which is achieved by adding NaOH (fig. 1 and fig. 2).
No increase in AOX in final bleached pulp is analyzed (fig. 3).

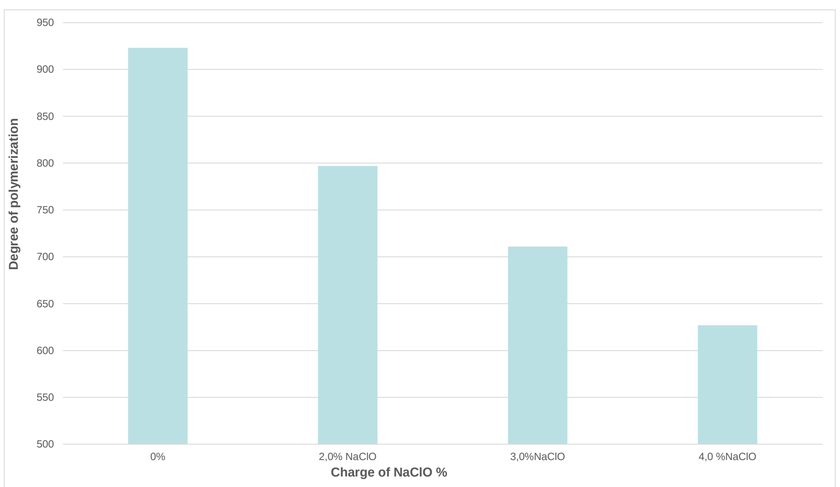

Fig. 1. Effect of NaClO addition in the EO stage on the final after the D1 stage pulp DP

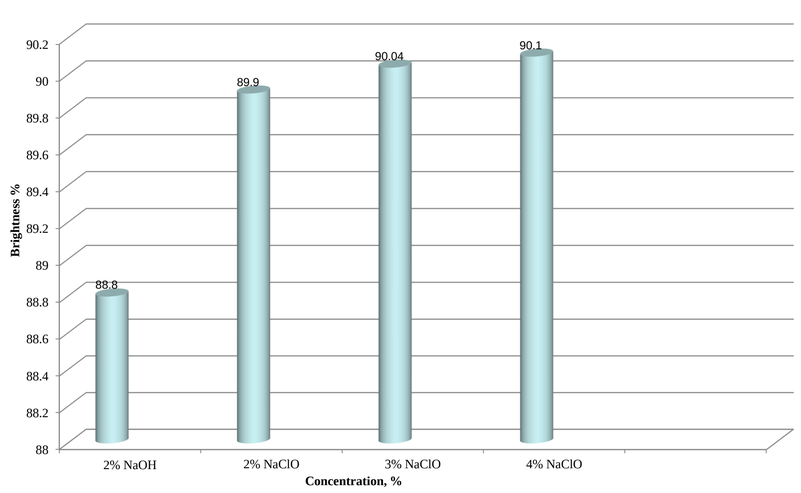

Fig. 2. Effect of NaClO addition in the EO stage on the final after the D1 brightness.

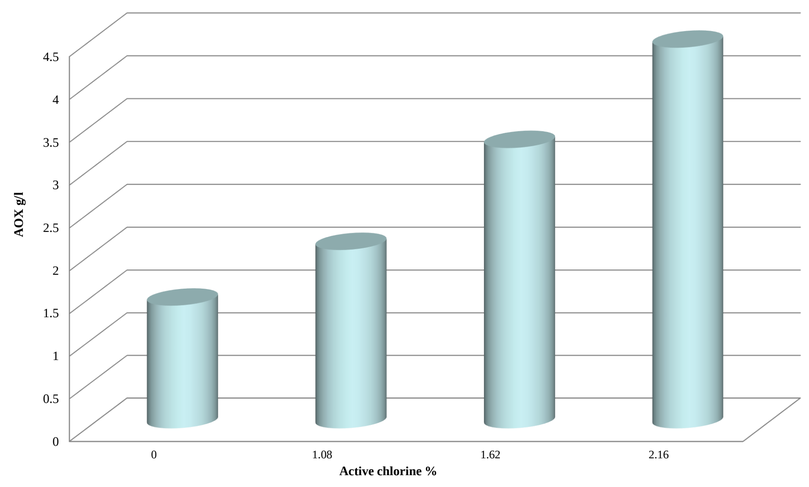

Fig. 3. Effect of NaClO addition in the EO stage on the final after the D1 AOX content of the pulp.

Similar results are obtained also after addition of hypochlorite in the final chlorine dioxide stage (fig. 4 and fig. 5). The experiment was carried out at 1.5% charge of active chlorine, reaction time 240 minutes at T 80°C and different alkali charges. Here, due to the alkaline conditions, a significant residue content of active chlorine is observed in the spent liquor. but this residual chlorine can be reused in the previous bleaching stages. The residual active chlorine can be reused in the previous D_o stage.

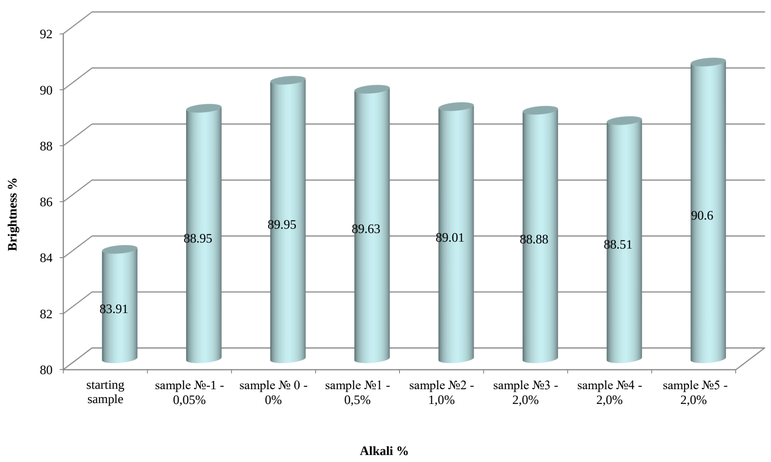

Fig. 4. Effect of reagents addition in D_1 stage on the pulp brightness.

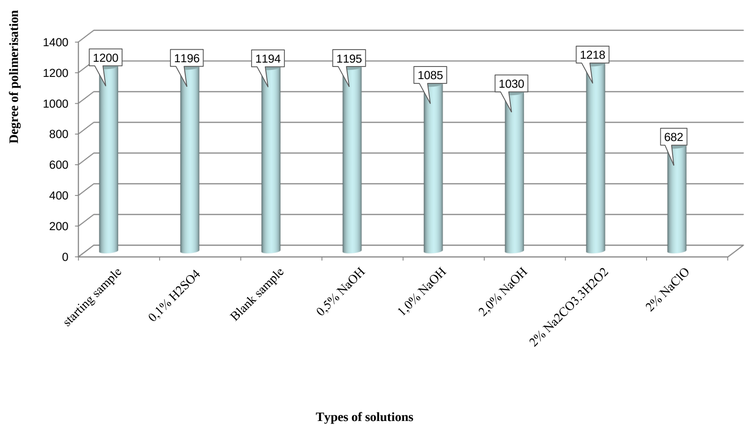

Fig. 5. . Effect of reagents addition in D_1 stage on the pulp DP.

CONCLUSION

In conclusion the hypochlorite appears to be the most suitable agent for controlled reduction of the final pulp viscosity without significant environmental problems.

Acknowledgments: This work is developed as part of contract №: BG-RRP-2.004-0002-C01, project name: BiOrgaMCT, Procedure BG-RRP-2.004 „Establishing of a network of research higher education institutions in Bulgaria“, funded by Bulgarian national recovery and resilience plan.